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Roosting activities of the Rainbow Lory *(Trichoglossus haematodus)* at Wau, Papua New Guinea

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Abstract

In September and October 1984 we studied flight patterns and roosting activities of the Rainbow Lory *(Trichoglossus haematodus)* at Wau (Papua New Guinea). Comparing arrival directions at the roost with the landscape patterns within these directions at varying distances, we suggest, that the main feeding habitats of the Lories must be at Wau and its adjacent villages. About 450 individuals use the roost and by calculating the feeding area of the Lory population, density is estimated around 40 to 50 birds/km^2. Evening flights continue over two hours until 18h30, morning flights over half an hour until 06h00. When feeding in towns and villages, the Lories forage in pairs, often joined by single birds. During roosting flights group size increases. The largest flocks were noted during departure in the morning.

Introduction

There has been a great deal of interest in social behaviour in avian biology during recent years. Communal roosting and breeding in colonies are centres of theoretical approaches (Horn 1968, Hamilton 1971, Ward & Zahavi 1973, for a recent review see Wittenberger & Hunt 1985). Simplified, two groups of hypotheses may account for the evolution of communal roosting behaviour in birds: Predator avoidance and food finding behaviour. In our paper we report some behavioural patterns of communal roosting Rainbow Lories *(Trioglossus haematodus).* We show that the majority of behavioural details are in accordance with the predator hypothesis.

Acknowledgements

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Materials and Methods

During a visit to Wau in 1984 we counted Rainbow Lories at a roost within the area of the Wau Ecology Institute (September 23, 24 and October 4, 6), and in their feeding habitats in the Morobe Province of Papua New Guinea. We collected four types of data:

1. On two dates (September 23 and October 6) we noted time and direction for each bird arriving at the roost.
2. In the main flight-belt we counted all arrivals at the roost in the evening (September 23, 24 and October 4) and all birds departing from the roost in the morning (September 24 and October 6).
3. All Lories were noted during excursions to Wau and its surroundings, Mt. Kaindi, Mt. Missim, Lae, and Salamaua. Some additional data are available for Port Moresby.
4. From aerial photographs and maps we analysed the distribution of settlements (number of houses and huts), coffee plantations, fields, grassland, forests and elevation around the roost (see Fig. 1). For villages within densely wooded plots we assumed a mean of 10 houses (for general landscape description see Gressitt & Nadkarni 1978).

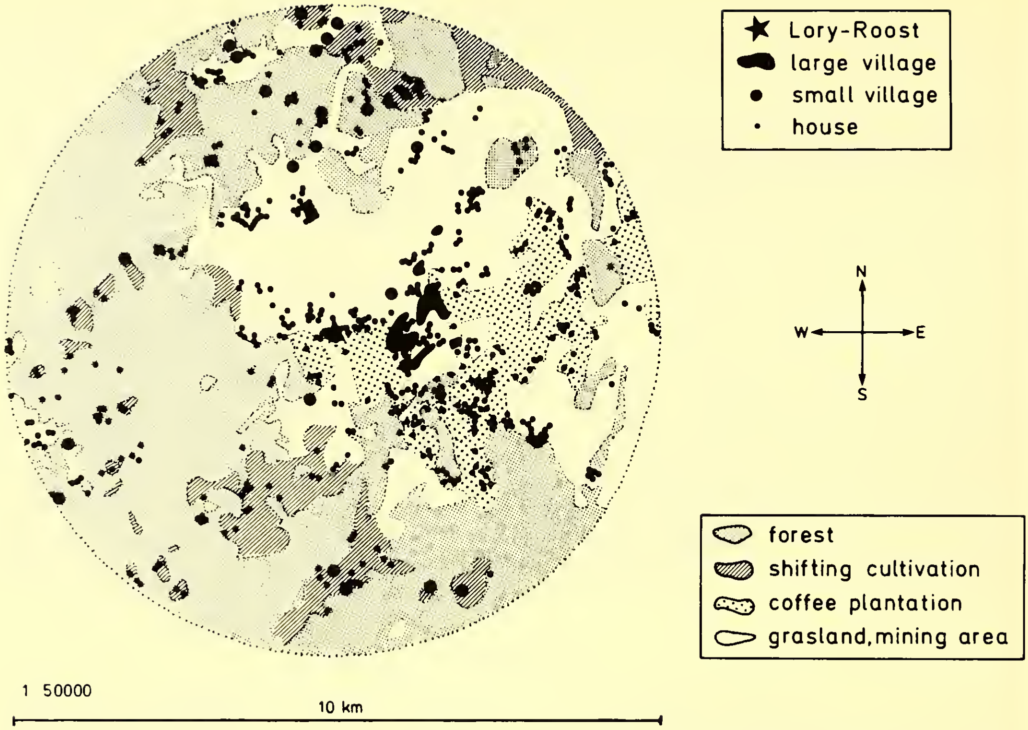

Fig. 1. Landscape pattern around the investigated roost of the Rainbow Lory at Wau, Papua New Guinea. The roost ist located in the centre of the circle.

Results

1. Size of the roost

Checking all parrot flights within the roost area and distinguishing between arriving birds and movements between three well defined tree groups on which the birds stopped before going to the actual roosting tree, we estimated the roost size. On September 23, 366 Lories arrived at the actual roosting site and remained there. From our counts of Lories arriving at the roosting area and the movements within this area, it became apparent that the above result under-estimates the actual roosting size of 20 % or more. Therefore the roosting population has to be estimated to more than 400 birds.

When we counted all Lories after they had collected at their actual roosting tree after the completion of all flying activities, about 450 Lories were found, clinging to twigs and branches.

On October 6, we estimated that there were about 451 Lories flying to the tree.

From these observations we suggest that a population of 450 to 480 Lories roosted at the grounds of the Wau Ecology Institute during our observations.

2. Arrival pattern and landscape

We noted the arrival directions of 675 Lories (232 on September 23; 443 on October 6; see Fig. 2). 75 % of all individuals arrived from south-east and east. In September, 25 % came from north and north-west, but this result did not hold for October.

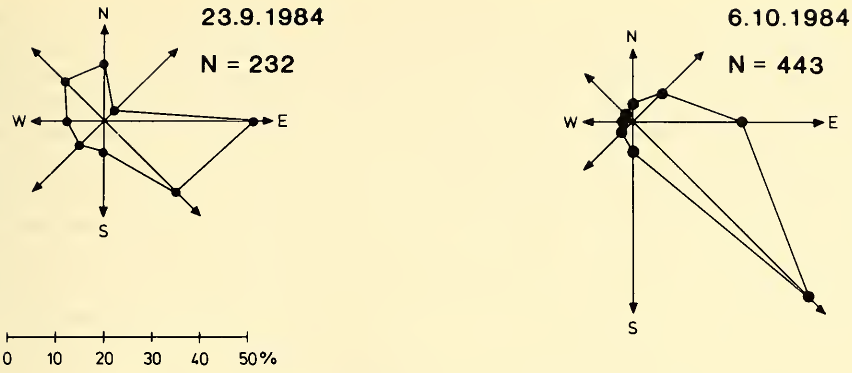

Fig. 2. Arrival pattern of the Rainbow Lories to the roost.

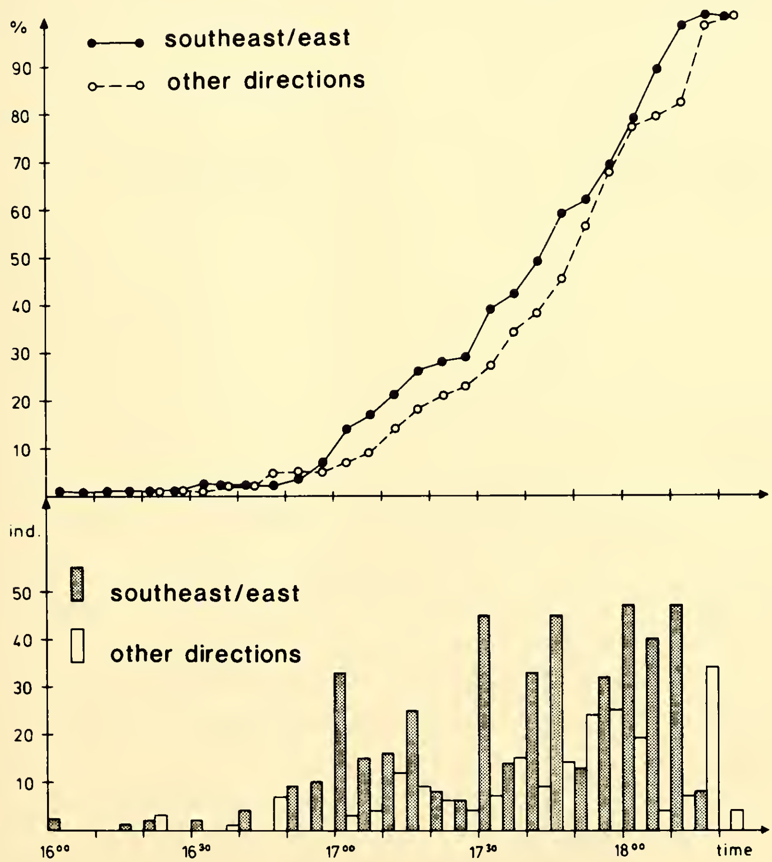

Fig. 3. Comparison of the arrival patterns along the main flight belt to the arrival from other directions.

If one accepts that the arrival pattern during the evening depends on the feeding site distribution, then one can assume that the parrots should arrive at the roost from those directions, where favourable landscape types are abundant. For a rough test, we estimated the proportion of the most important landscape types (see Fig. 1) within 8 segments (N, NE, E, SE, S, SW, W, NW) for the distances 0–1, 1–2, 2–3, 3–4 and 4–5 km around the roost and compared these data with the number of Lories arriving form these directions by rank correlation.

Tab. 1 presents the results. For the distances 1–2 and 2–3 km the positive correlation coefficients are significant for the parameters, settlements and coffee plantations. A negative correlation is found for the relation between arrival pattern and wooded area as well as elevation. This indicates that in the Wau area the Rainbow Lory is a garden bird more common in disturbed habitats than in rain forests (Beehler 1978, Beehler et. al. 1986) and which forages during the day within settlements, or coffee plantations, 1–4 km east and southeast of the roost (centre of Wau and surroundings; Fig. 1).

Birds coming from other directions will only find similar feeding conditions at greater distances from the roost. If parrots coming from north, west and south have to feed at greater distances than those arriving at the roost from east and southeast, the former should arrive at the roost later than the latter, assuming that the birds depart from their feeding sites at about the same time. Fig. 3 compares arrival time from the east/southeast with other directions: the expected time shift is obvious.

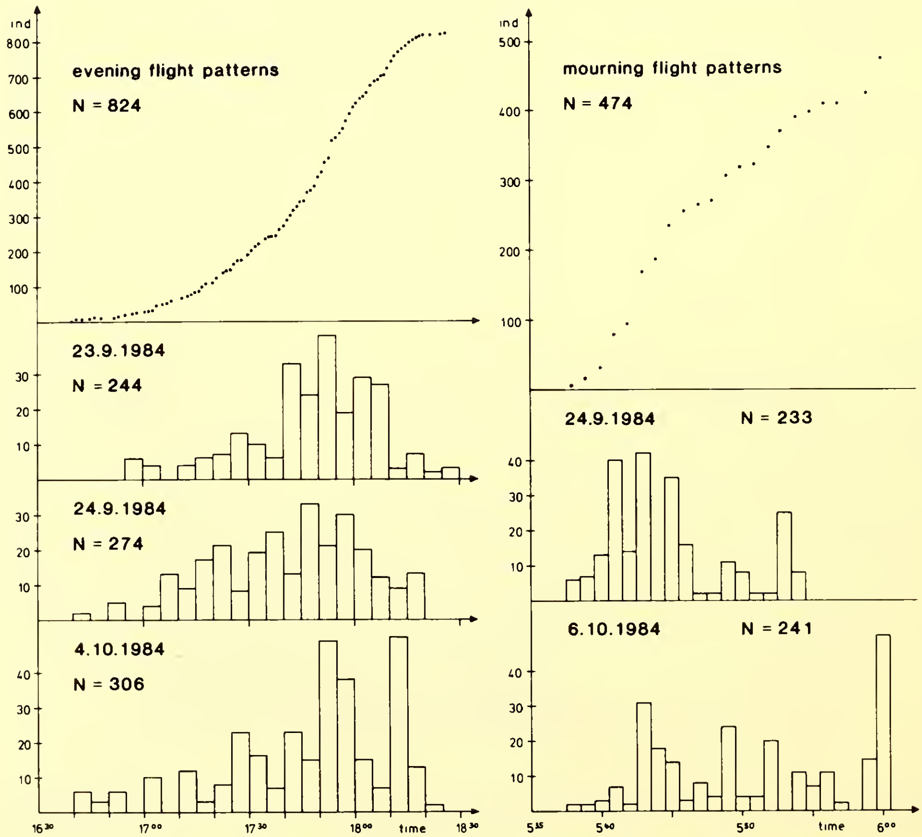

Fig. 4. Arrival and departure for the Rainbow Lories.

Outside of the 5 km-radius forests and, along the Bulolo river, grasslands cover nearly the total area and the abundance of Lories may be very low. We therefore suggest that nearly the total population of the Rainbow Lory in the Wau area roosts near the Wau Ecology Institute.

Good feeding habitats (settlements, coffee plantations) within the 5 km-radius amount to about 1 000 ha. If one includes suboptimal sites (fields, areas with shifting cultivation), about 2 500 ha may provide feeding habitats for the Rainbow Lory. In September/October 1984 an estimation of the average density in the Wau region may be around 20 ind./km^2. In the immediate vicinity of Wau, a density of 40–50 ind./km^2 may be a good estimate.

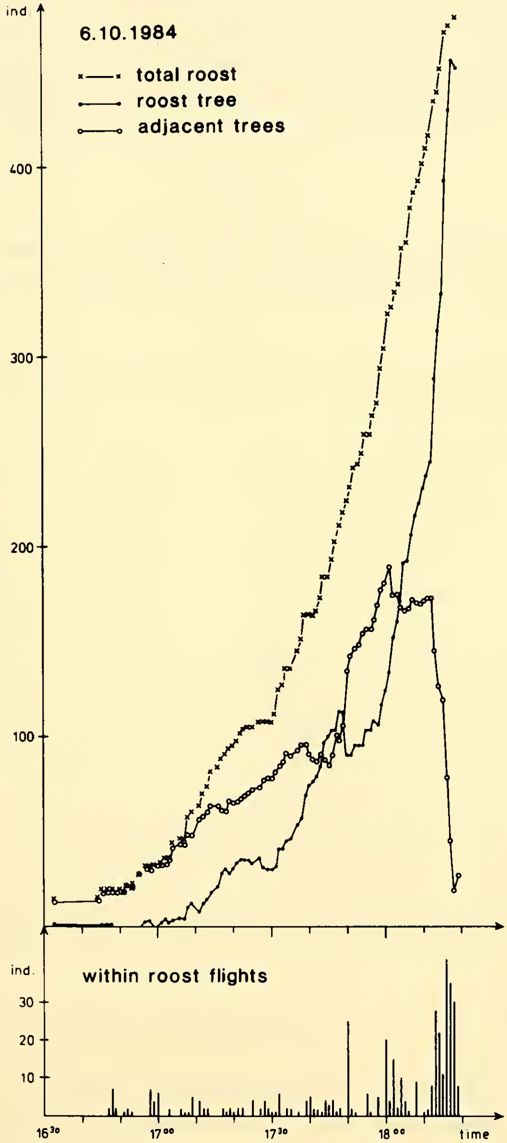

Fig. 5. Above: sum of all individuals at the roost, number of individuals sitting at the actual roosting tree and individuals at adjacent trees. Below: flying activities within the roost.

3. Flight patterns

Flight patterns in the course of time for the Lories arriving at or leaving the roost were checked from a clearing beneath the roost. Fig. 4 shows the results. Evening flights continued over two hours (16h30–18h30), morning flights over half an hour (05h30–06h00). Sunset was around 18h00, sunrise around 06h00.

4. Roost characteristics and flights within the roost

The acutal roosting tree was 25 m high, of slender shape with horizontal branches, without any contact with adjacent trees. During evening flights, arriving Lories mostly collected within the roost area on adjacent trees, and the actual roosting tree is occupied in the late evening (Fig. 5).

5. Flock size

Flock size changes throughout the day (Tab. 2). While feeding in towns and villages, the Lories mostly forage in pairs (58 % of all observed flocks). This pattern differs from that during the observa-

Tab. 1. Rank correlation coefficients (Spearman) between the number of Rainbow Lories arriving from different directions at the roost and the pattern of the landscape within these directions at varying distances.

distance	number of houses/huts	% coffee plantations	% field	% grassland	% forest	elevation
0–1 km	−0.45	−0.37	0.32	0.13	−0.01	−0.84*
1–2 km	0.86*	0.73*	0.31	0.03	−0.40	−0.79*
2-3 km	0.83*	0.74*	0.54	0.19	−0.74*	−0.79*
3–4 km	0.43	0.75*	−0.38	0.57	−0.80*	−0.79*
4–5 km	−0.41	0.34	−0.09	0.76*	−0.73*	−0.63*

* $P < 0.05$; two-tailed;

Tab. 2. Flock site distribution of Rainbow Lories during feeding, roost arrival, within roost flights and departure from the roost.

	N flocks	N birds	mean flock size	flock size % 1	2	3	4	5	6	≧ 7
feeding	24	59	2.5	8	58	17	13	4	0	0
arrival	283	830	2.9	13	47	12	12	6	5	5
within roost	299	893	3.0	27	40	8	20	5	3	7
departure	125	474	3.8	14	45	11	11	5	0	14

tions at the roost, where only 40 % of the flocks seemed to be pairs. On the other hand, 25 % of the "flocks" observed at the roost were single birds, compared to 8 % during feeding. Average flock size, mainly due to the proportion of large flocks, increased from feeding flights during the day to evening flights, within roost flights and morning flights. Large flocks occur during the departure in the morning (Tab. 2).

Discussion

The majority of patterns within the observed behaviour of the Lories may be explained by the influence of predators:

1. According to the arguments of Pulliam (1973) the anti-predator benefit of grouping should reach a maximum in flock sizes of much less than 1 000 (but see Sibly 1983). This suggests that anti-predator benefits are not the major factor in the huge roosting groups of some birds (Starling, Quelea) and colonies of seabirds (Brandl 1987). But the roost size of our species is large enough to gain the optimum of anti-predator benefits.

2. The roost site is situated within the property of the Wau Ecology Institute, an area in which hunting is prohibited. The Lories have choosen a safe place for roosting. From arguments, based on energetic considerations, theory about food finding and roosting predicts that the roosting site should be located within the centre of the foraging area. Our results (Fig. 2) demonstrate an acentric location of the roost, a result also found with roosting herons and egrets (Utschick & Brandl 1986; but see Wittenberger & Dollinger 1984). The process in choosing a roosting area is influenced more by predation than by energetic foraging arguments.

3. The actual roosting tree does not remain the same (F. Gölthenboth, personal communication). From time to time the birds use a different tree. This may also be interpreted as an anti-predator behaviour: the roosting site should be as unpredictable as possible for potential predators.

4. This argument also illuminates the behaviour of the Lories, which do not collect on the actual roosting tree during arrival. The arrival of many chattering birds over two hours would easily attract predators to the actual roosting tree.

5. The actual roosting tree has vertical branches without any contact to neighbouring trees. This may reduce the probability of predators arriving via these trees at the roost.

Only one behavioural detail is interpretable within the context of food finding: the departure of birds in the morning. The group size during departure is larger than during arrival or during the day. Lories fly in groups to the foraging sites within a very short space of time. Birds that were unable to find food on the preceding day may follow successful birds to the feeding areas ("information centre hypothesis"; Ward & Zahavi 1973), especially when good food resources are unpredictable. Flowering and fruiting trees in the tropics may be unpredictable.

In the main our observations were hampered by the problem of counting anonymous birds (Caccamise & Morrison 1986). Therefore, one can easily create plausible hypotheses without any chance of a rigorous test between alternative explanations. Radio-tagging is a powerful method of overcoming this problem (for an example see Gorke & Brandl 1986).

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